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I, the undersigned, being an officer duly authorised in accordance with Section 62(3) of the Patents and Designs Act 1907, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the Patent application identified therein.

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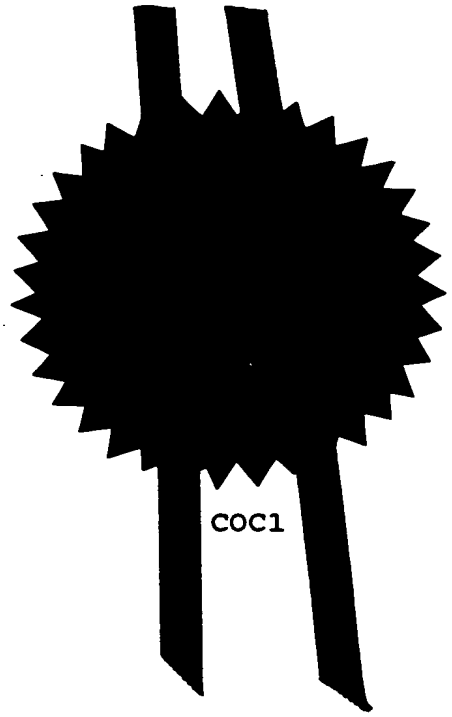

Signed A.W. Russell

Dated 17th October 1991

PATENTS ACT 1977

PATENTS FORM NO. 1/77 (Revised 1982)

(Rules 16, 19)

-20CT'90#00387783 PAT 1 77 UC 15.00

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9021253.1

REQUEST FOR GRANT OF A PATENT

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THE GRANT OF A PATENT IS REQUESTED BY THE UNDERSIGNED ON THE BASIS OF THE PRESENT APPLICATION

I Applicant's or Agent's reference *(Please insert if available)* P8698/CT/NP/BW

II Title of invention "Method of and Apparatus for the Transmission of Data via a Sonic Signal"

III Applicant or Applicants *(See note 2)*

Name (First or only applicant) Metrol Technology Limited

Country United Kingdom State ADP Code No. 4057303001 1mw

Address 1 Whitemyres Avenue, Mastrick Industrial Estate, Aberdeen, AB2 6HQ, Scotland, United Kingdom

Name (of second applicant, if more than one)

Country State

Address

IV Inventor (see note 3)

(a) The applicant(s) is/are the sole/joint inventor(s)

or

(b) A statement on Patents Form No 7/77 is/will be furnished

V Name of Agent (if any) *(See note 4)* Murgitroyd and Company ADP CODE NO 1198001

VI Address for Service *(See note 5)* Mitchell House
333 Bath Street
Glasgow G2 4ER

VII Declaration of Priority *(See note 6)*

Country	Filing date	File number

THE PATENT OFFICE
29 SEP 1990
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VIII The Application claims an earlier date under Section 8(3), 12(6), 15(4), or 37(4) *(See note 7)*

Earlier application or patent number and filing date

IX Check List *(To be filled in by applicant or agent)*

A The application contains th following number of sheet(s)		B The application as filed is accompanied by:-	
1 Request	1 Sheet(s)	1 Priority document	–
2 Description	5 Sheet(s)	Translation of priority document	–
3 Claim(s)	– Sheet(s)	3 Request for Search	–
4 Drawing(s)	1 Sheet(s)	4 Statement of Inventorship and Right to Grant	–
5 Abstract	– Sheet(s)		

X It is suggested that Figure No.....of the drawings (if any) should accompany the abstract when published.

XI Signature *(See note 8)* (Murgitroyd and Company)

NOTES:

1. This form, when completed, should be brought or sent to the Patent Office together with the prescribed fee and two copies of the description of the invention, and of any drawings.

2. Enter the name and address of each applicant. Names of individuals should be indicated in full and the surname or family name should be underlined. The names of all partners in a firm must be given in full. Bodies corporate should be designated by their corporate name and the country of incorporation and, where appropriate, the state of incorporation within that country should be entered where provided. Full corporate details, eg a "corporation organised and existing under the laws of the State of Delaware, United States of America", trading styles, eg "trading as xyz company", nationality, and former names, eg "formerly (known as) ABC Ltd" are *not* required and should *not* be given. Also enter applicant(s) ADP Code No.(if known).

3. Where the applicant or applicants is/are the sole inventor or the joint inventors, the declaration (a) to that effect at IV should be completed, and the alternative statement (b) deleted. If, however, this is not the case the declaration (a) should be struck out and a statement will then be required to be filed upon Patent Form No 7/77.

4. If the applicant has appointed an agent to act on his behalf, the agent's name and the address of his place of business should be indicated in the spaces available at V and VI. Also insert agent's ADP Code No. (if known) in the box provided.

5. An address for service in the United Kingdom to which all documents may be sent must be stated at VI. It is recommended that a telephone number be provided if an agent is not appointed.

6. The declaration of priority at VII should state the date of the previous filing and the country in which it was made and indicate the file number, if available.

7. When an application is made by virtue of section 8(3), 12(6), 15(4) the appropriate section should be identified at VIII and the number of the earlier application or any patent granted thereon identified.

8. Attention is directed to rules 90 and 106 of the Patent Rules 1982.

9. Attention of applicants is drawn to the desirability of avoiding publication of inventions relating to any article, material or device intended or adapted for use in war (Official Secrets Acts, 1911 and 1920). In addition after an application for a patent has been filed at the Patent Office the comptroller will consider whether publication or communication of the invention should be prohibited or restricted under section 22 of the Act and will inform the applicant if such prohibition is necessary.

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"Method of and Apparatus for the Transmission of Data via a Sonic Signal"

This invention relates to a method of and apparatus for the transmission of data via a sonic signal, preferably but not exclusively along an elongate member within an oil well.

To optimise the efficiency both of the detection of oil reserves and the recovery of these reserves, it is important to obtain as much detailed information as possible about the ambient environmental conditions at the base of an oil well. This information is obtained by a variety of sensors located at the base of a well when required. The information obtained by the sensors may be transmitted to the surface of an open well using sonic waves which propagate through the drilling mud.

However, this method may not be employed when a valve or plug is inserted in the well resulting in there being no direct fluid path from the base of the well to the surface.

It is possible to adapt valves to produce a hydraulic or electrical path through the valve to enable the

transmission of signals from a sensor below the valve to a receiver above the valve. The said paths terminate in a connector which is suitable for connection to the receiver, the receiver in turn being connected via a cable to the surface of the well.

However, this system is extremely difficult to operate as the small connector on the surface of the valve is extremely difficult to contact with the receiver and a considerable length of time is taken to make a suitable connection.

According to a first aspect of the present invention there is provided a method of transmission of data by a sonic signal, comprising converting an electrical signal to a sonic signal, transmitting the longitudinal component of the sonic signal along a member, detecting the transmitted sonic signal and re-converting it to an electrical signal.

Preferably, the sonic signal is modulated at a predetermined frequency to allow phase sensitive detection techniques to be utilised.

The frequency is chosen to enable optimum transmission efficiency and minimum loss.

Preferably, when the method is used in the transmission of data from a point below a valve in an oil well, to a point above the valve, the sonic signal is transmitted through the valve and detected by a transducer on the top surface of the valve, whereupon the signal is converted to an electric signal which is transmitted to the well surface.

Alternatively, the detected signal may be boosted in strength and a second corresponding sonic signal may be directed to the surface via a well member such as the drill string.

According to a second aspect of the present invention there is provided apparatus for use in the aforesaid method of transmission of data by a sonic signal, comprising a means of receiving an electrical signal and converting the said electrical signal into a sonic signal via a magneto-striction device.

Preferably, the magneto-striction device includes an electromagnetic coil which may be placed around an elongate member such that the application of a current to the coil produces a magnetic field which results in the longitudinal contraction or expansion of the member.

Thus, the magneto-striction device may produce a longitudinal sonic signal in an elongate member when applied at any point along the length of the member.

Preferably, the apparatus further includes a transducer capable of receiving the said sonic signal and converting it into an electrical signal.

As a longitudinal mode of sonic signal is employed the transmission losses along the elongate member are minimised and there is no loss to any fluid which comes in contact with the member.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawing which is a schematic diagram of

the apparatus of the present invention in use in accordance to the method of the present invention.

The figure shows a means 1 of receiving an electrical signal and converting said signal into a sonic signal via a magneto-striction device 2.

The magneto-striction device 2 includes an electromagnetic coil 3 which may be placed around an elongate member 4 such that the application of the current to the coil 3 produces a magnetic field which results in the longitudinal contraction or expansion of the member 4. Thus, the magneto-striction device 2 may produce a longitudinal sonic signal in an elongate member 4 when applied at any point along the length of the member 4.

The apparatus further includes a transducer 5 capable of receiving the said sonic signal and converting it into an electrical signal.

As a longitudinal mode of sonic signal is employed, transmission losses along the elongate member are minimised and there is no loss to any fluid which comes in contact with the member 4.

When in use the device 1 is applied to a pipe within a well, positioned below a valve 6 within the well. An electrical signal from a well sensor is supplied to the means 1 and converted into a signal which drives the magneto-striction device 2, the said magneto-striction device 2 then transmits the signal via the elongate member 4 to a point above the valve 6, whereupon it is detected by the transducer 5 and reconverted to an electrical signal.

The electrical signal may then be transmitted to the surface via an electrical cable 7. Alternatively, the electrical signal may be reconverted to a sonic signal and boosted in strength. The second corresponding sonic signal may then be directed to the surface via an elongate member such as the drill string.

The sonic signal is modulated at a predetermined frequency to allow phase sensitive detection techniques to be utilised. The frequency is chosen to enable optimum transmission efficiency and minimum loss. For example, frequencies which would result in total internal reflection at the valve surface are avoided.

Minimal losses may occur when the drill string contacts the surface casing of the well. However, little loss results due to the longitudinal nature of the sonic wave employed.

Modifications and improvements may be incorporated without departing from the scope of the invention.

MURGITROYD AND COMPANY
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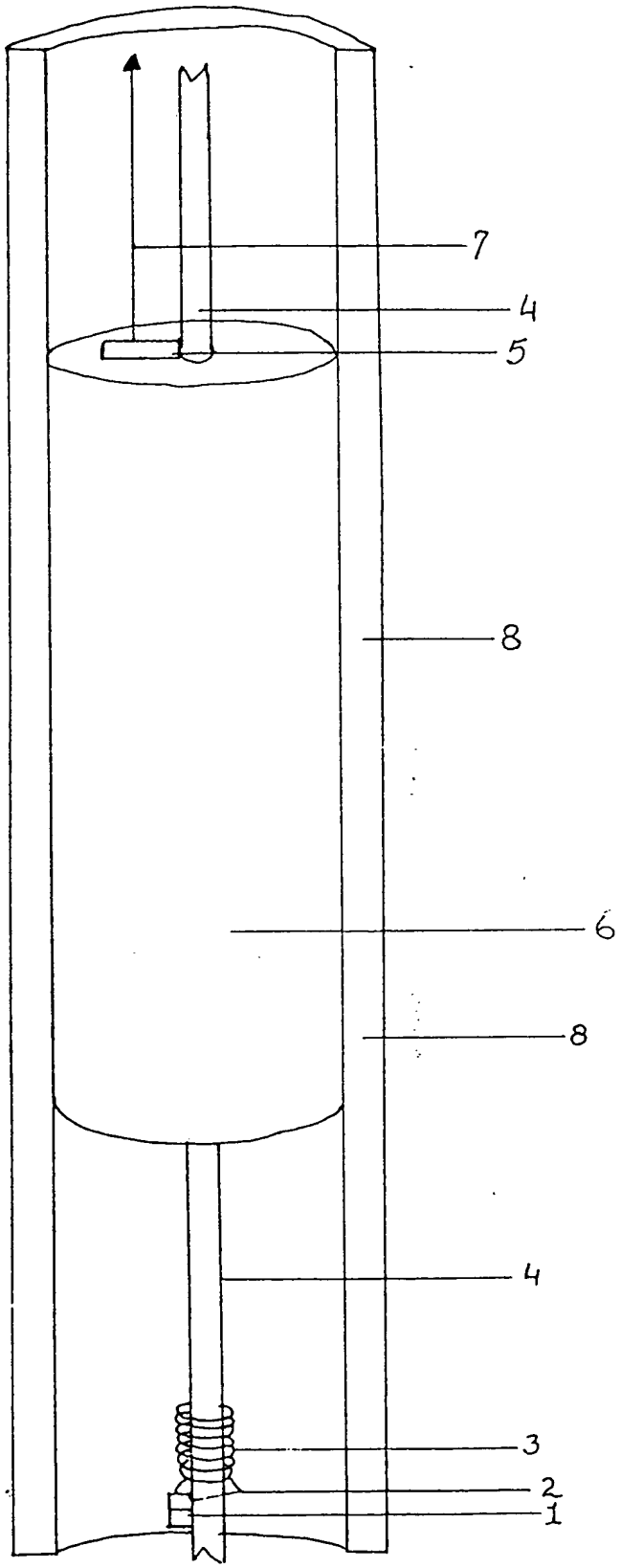
1/1



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